# NPCW Forest Plan Revision- Consideration of HRV-NRV and Climate Change in Desired Conditions for Species Composition and Size Classes

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# Summary

Defining desired conditions for the forest landscapes of the NPCW requires selecting indicators that describe the forest, and that allow measurement of departure from reference conditions, as well as monitoring of change. Many indicators are used in current practice, including species composition, size class distribution, density, seral stages, stand development stages, disturbance regimes and average patch sizes, landscape connectivity/fragmentation, etc. During the assessment and initial round of FP revision, species composition and size class were chosen as indicators of seral and structural conditions due to their ease of application and relevance to historic reference conditions, as well as the limitations of the SPECTRUM model in dealing with inventory data and spatially-related concepts such as connectivity, patch size, and fragmentation..

Historical information and state and transition modeling were used to describe a natural range of variation (NRV) based on species composition and size class distribution. Desired conditions are influenced by the generally accepted realization that most forests in the interior PNW are out of line with respect to historical conditions, and there is a need to increase resilience of most forest types to disturbances from wildfire and insects and disease, as well as predicted changes in climate. In short, species composition has shifted substantially away from early seral, fire tolerant and disease resistant species and towards late seral, fire and disease susceptible species; size class distributions have also changed tremendously from large-diameter trees resistant to mixed-severity fire regimes to mid-size trees susceptible to lethal fire effects (Lehmkuhl et al 1994).

**Desired conditions for species composition and size class for the two ecosections found on the NPCW are given in the tables that follow in this summary section.** These were informed by the sources of information described below and were based on the assumption that it is necessary to move species composition and size class distributions substantially away from current conditions in order to increase resilience of these forests to important stressors. (See *Desired Conditions from Historical Information/Modelling/Climate Change Considerations* below for comparison with the Proposed Action and simulation modeling).

**Desired Condition Ranges %**

| ID Batholith | Breaklands | | Uplands | | Subalpine | |
|---|---|---|---|---|---|---|
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| Ponderosa pine/mix | 42 | 50 | 17 | 40 | 4 | 10 |
| Douglas-fir | 11 | 13 | 3 | 10 | 5 | 7 |
| Lodgepole pine | 7 | 8 | 18 | 24 | 17 | 20 |
| Western larch/Douglas-fir | 7 | 8 | 10 | 20 | 5 | 15 |
| Grand fir/western redcedar | 3 | 10 | 4 | 25 | 2 | 7 |
| White pine | 1 | 2 | 1 | 2 | 1 | 2 |
| Subalpine fir/spruce mix | 1 | 1 | 2 | 6 | 5 | 14 |
| Subalpine fir/whitebark pine | 0 | 0 | 0 | 0 | 20 | 26 |
| Seral grass/shrub | 6 | 15 | 7 | 10 | 6 | 20 |
| Nonforest | 8 | 8 | 0 | 0 | 7 | 7 |

| ID Batholith | Breaklands | | Uplands | | Subalpine | |
|---|---|---|---|---|---|---|
| **Size Class/Seral Stage** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| Non-forest | 8 | 8 | 0 | 0 | 7 | 7 |
| Seral grass/shrub | 6 | 15 | 7 | 10 | 6 | 20 |
| 0-4.9 inches (seeds/saps-early) | 7 | 20 | 15 | 25 | 15 | 30 |
| 5-14.9 inches (small/med.-mid) | 20 | 40 | 20 | 45 | 20 | 35 |
| 15-19.9 inches (large-mid-late) | 10 | 25 | 10 | 35 | 10 | 30 |
| >= 20 inches (very large-late) | 10 | 32 | 10 | 25 | 5 | 15 |

**Desired Condition Ranges %**

| Bitterroot Mts. | Breaklands | | Uplands | | Subalpine | |
|---|---|---|---|---|---|---|
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| Ponderosa pine/mix | 10 | 20 | 10 | 15 | 1 | 3 |
| Douglas-fir | 5 | 7 | 1 | 4 | 5 | 10 |
| Lodgepole pine | 2 | 3 | 3 | 6 | 25 | 35 |
| Western larch/Douglas-fir | 20 | 30 | 20 | 30 | 5 | 15 |
| Grand fir/western redcedar | 5 | 15 | 5 | 25 | 5 | 10 |
| White pine | 25 | 35 | 25 | 35 | 5 | 15 |
| Subalpine fir/spruce mix | 0 | 1 | 1 | 4 | 5 | 20 |
| Subalpine fir/whitebark pine | 0 | 0 | 0 | 0 | 5 | 15 |
| Seral grass/shrub | 5 | 15 | 5 | 10 | 5 | 15 |
| Nonforest | 1 | 1 | 0 | 0 | 1 | 1 |

| Bitterroot Mts. | Breaklands | | Uplands | | Subalpine | |
|---|---|---|---|---|---|---|
| **Size Class/Seral Stage** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| Non-forest | 1 | 1 | 0 | 0 | 1 | 1 |
| Seral grass/shrub | 5 | 15 | 5 | 10 | 5 | 15 |
| 0-4.9 inches (seeds/saps-early) | 10 | 20 | 15 | 30 | 10 | 25 |
| 5-14.9 inches (small/med.-mid) | 20 | 35 | 20 | 40 | 20 | 45 |
| 15-19.9 inches (large-mid-late) | 15 | 35 | 15 | 25 | 15 | 40 |
| >= 20 inches (very large-late) | 10 | 35 | 10 | 30 | 5 | 20 |

# Introduction

Historic forest conditions can provide a context for understanding the ecological processes (including fire, insects and disease) that shaped the ponderosa pine, dry and moist mixed-conifer forests, and upper elevation forests in this area. Disturbance processes and patterns created stand structures to which wildlife species have adapted. Historical reconstructions are not a blueprint for management, but are reference conditions for understanding ecological systems and processes.

Management that promotes resilient forest landscapes is a cornerstone of the current emphasis on restoration of historic species composition and structure in the interior western U.S. Resilient forests tend to return to the desired prior condition after a disturbance. Promoting resilience is often cited as a way of managing in light of the uncertainty of climate change, and moving landscapes towards a historic range of variability is the method of achieving resilience to historic disturbance regimes.

Species composition is the best overall integration of resilience to climate change and disturbance regimes. Species respond to changes in environment, while successional classes or developmental stages do not. Insect and disease activity is highly correlated with species composition. Fire resilient species (PP, WL,WP) have decreased substantially on the landscape, so their presence/abundance on the landscape is an indicator of resilience to fire at all successional/developmental stages. Also, in monitoring, species composition is the most sensitive to change over time, versus successional/developmental stages or size classes.

Size class is a general proxy for seral stage, development stage, and structural stage. It does not incorporate species composition whereas a seral/structural stage classification could. However, in combination with species composition it is possible to determine where the landscape stands in regards to early and late seral species and stand structures. Classifications based on combinations of species composition, size class, density, and number of layers integrate several indicators, but also have drawbacks when attempting to crosswalk with wildlife habitat definitions and other management guidelines (such as target stands) based on those metrics at mid- and project-level planning.

There are pluses and minuses to using any of the aforementioned indicators. The advantages of using species composition and size class are that they are easily measured, and are elemental metrics that can be used in any current or future classifications of seral/structural/development stages and wildlife habitat, and methods of determining departure from desired conditions. This approach is also consistent with other FP revision efforts underway in R1and with the Regional broad-scale monitoring strategy (B. Bollenbacher, pers. comm.).

# Manual Direction

### *23.11 - Plan Components for Ecosystem Integrity and Ecosystem Diversity*

### *23.11a – Natural Range of Variation*

*The plan components designed to maintain or restore the ecosystem integrity of the diversity of terrestrial, riparian, and aquatic ecosystems and habitat types throughout the plan area provide the ecosystem (coarse-filter) approach to maintaining the persistence of native species. When developing such plan components, the responsible official shall consider the role of the natural range of variation as follows:*

*1. <u>NRV should be used to design plan components if appropriate</u>. If appropriate, the responsible official should design plan components to facilitate maintenance or restoration of specific key ecosystem characteristics needed to restore ecosystem integrity by moving conditions towards those* *created under ecological processes and landscape disturbance regimes that occurred before extensive human alteration.*

# Sources of Historical Information

1. 1900 Bitterroot Forest Reserve Report- aka Leiberg Report- broad assessment of cover types, composition, and age classes by drainage

2. 1937 Forest Inventories- measured timber types and size classes and mapped them

3. 1994 Losensky report prepared for ICBEMP- ecosection summaries of composition, age/size classes, and structural stages from 1930s inventory data and county information, backdated to 1900

4. ICBEMP historical change analysis- comparison of 1930s to 1980s aerial photos (Lehmkuhl et al. 1994) for the Pend Oreille River Basin (representative of northern Rockies ecoregion)

5. Mehringer (1996) late quaternary environments (ICBEMP report)- post glacial changes in vegetation in relation to climate fluctuations

6. SIMPPLLE model simulations of the NRV using disturbance regimes and climatic variation

## Reference Period

The appropriate historical reference period is generally considered to be before or at the time of significant Euro-American settlement (Losensky 1994) when primarily natural but Native American-influenced process were at work. However, only anecdotal, non-quantifiable information exists from this period. Therefore, the reference conditions from historical sources are taken from approximately the early 1900s to about the middle-1930s. After creation of the forest reserves in the 1890s, forest-wide assessments were undertaken (e.g. Leiberg's report) which were broad-scale in nature with both qualitative and quantitative information. Beginning in the 1930s, measured forest inventories were started, usually organized by counties. The Nez Perce and the Clearwater both have inventory data that was compiled in 1937. Also, the ICBEMP effort looked at changes in composition and landscape pattern in the Pend Oreille River basin (representing the northern Rockies ecoregion) by comparing aerial photos from the 1930s with photos from the 1980s.

In the Idaho Batholith region, timber harvest associated with mining began in the 1860s, but was not a major activity until after 1900 (Losensky 1994). In the Bitterroot Mountains, the 1889 fires had a profound effect on size classes (Losensky 1994, Leiberg 1898). The fires of 1889 and 1910 were rare (in terms of the historic fire regimes in this area and the historic range of variability) (Chatters and Leavell 1994), and appear to be the result of a unique combination of weather factors (especially hurricane-force winds) that caused these million-acre fires. While stand-replacing fires are considered to be a part of the historic fire regime, mixed severity fires were also a part of the pattern (Smith and Fischer 1997). Especially in the grand fir series, where PP-WL-WP were early-seral dominants, most stands would have been "groomed" by surface fires and kept at a lower propensity towards stand-replacement fire. Given that the 1889 and 1910 fires appear to be at a high variance from the mean conditions, management for this fire regime would be counterproductive (i.e., management actions could be taken to restore resilience to more modal conditions).

These sources of historic information are invaluable in providing context to vegetation responses to disturbance regimes and climate of the several centuries prior to the pre-Euro-American settlement period. Although these processes operated over large landscapes and the information on species composition and size classes could be thought of as "averages", they more likely represent a "point in time” with unique climate and disturbance regimes, and this slice of time may be an inadequate reference for guiding the management of future landscapes especially in light of predicted rapid climate change (Keane et al. 2009).

Mehringer’s 1996 ICBEMP report on environments after the last glacial advance provides some context on the role of climate in shaping vegetation. The author concludes that vegetation change has been continual and unpredictable, that even long-lived trees respond rapidly to climate change, and the steppe-conifer ecotone has been in flux over the past 12,000 years. Also, he concludes the current composition and distribution of tree species in the northern Rockies has only been in place for approximately the last 1500 to 2000 years.

# Disturbance Processes and Patterns

## Fire Regimes

The dominant, historical fire regime that occurred within forested vegetation in the Inland Empire can be characterized as a variable or mixed-severity fire regime (Zack and Morgan 1994, Kilgore 1981, Brown 2000). This type of fire regime commonly had a moderately short fire-return interval for nonlethal or mixed severity fires, with lethal crown fires occurring less often. Relative to the other two common fire regimes that are often recognized for forested vegetation—the nonlethal and stand-replacement regimes—the mixed-severity fire regimes are the most complex (Agee 2004). Individual mixed-severity fires typically leave a patchy pattern of mortality on the landscape, which creates highly diverse communities. These fires kill a large percentage of the more fire-susceptible tree species (e.g., hemlock, grand fir, subalpine fir, lodgepole pine) and a smaller proportion of the fire-resistant species, including western larch, ponderosa pine, whitebark pine, and western white pine (Arno et al. 2000).

## Insects and Disease

Historically, western white pine was a common tree species on the Clearwater National Forest, and dominated a very large part of the moist habitat types. In the early part of the 20th century, white pine blister rust (a Eurasian disease) was accidentally introduced to western North America. This exotic disease, combined with a mountain pine beetle outbreak in white pines in northern Idaho in the late 1930s, has been the primary cause for the loss of white pine in this area (Neuenschwander et al. 1999). With the loss of white pine, there have been large increases in the amount of Douglas-fir and subalpine fir cover types, and a major acceleration of forest succession toward shade-tolerant, late-successional true firs, hemlocks, and cedars.

Root disease study plots over all of northern Idaho show that over the past 40 years, the incidence of root disease has increased, as has the resulting mortality in susceptible tree species. This increase has been in both the extent of root diseases, and the intensity of the diseases. In many cases, this is a result of the loss of western white pine, which has increased the presence of susceptible species such as Douglas-fir and grand fir.

Root disease is the leading cause of tree mortality on the Nez Perce National Forest (22% of all mortality), and the Clearwater National Forest (49% of all mortality). Root diseases affect more acres on these National Forests than wildland fire, bark beetles, and timber harvest combined. Because root diseases can reduce tree growth and stocking densities for many decades, their effects on forest carbon stocks and flux are more persistent than the effects of other disturbance agents.

Douglas-fir beetle and the fir engraver beetle on grand fir are major factors in the observed mortality of Douglas-fir and grand fir. The activity of these bark beetles appears to be associated primarily with trees weakened by root diseases. Blowdown of Douglas-fir with weakened root systems also contributes to the buildup of Douglas-fir beetle populations, leading to attacks of surrounding standing trees.

The mountain pine beetle has continued to be active over the last 10 years. It is often the secondary agent responsible for the death (delivering the coup de grace) of white pine infected with blister rust. However, its main role is as the key agent in regenerating patches/stands and individuals of mature (80-120 year old) lodgepole pine.

# Climate Change Considerations

Past climate is a potentially confounding factor in using historic reference conditions. Recruitment of trees is especially sensitive to climate, and current old-growth forests regenerated under the climate of the Little Ice Age and may not reflect how old-growth would develop under present and future climates. The Medieval warm period may actually provide a more representative reference condition for present and future climate projections (Millar and Woolfenden 1999). Restoration of landscapes towards a historic range of variability found before Euro-American settlement (i.e. Little Ice Age climate) would likely result in forests that are more resistant and resilient to disturbance and expected climate change than most current forests in the western U.S., however consideration of expected future environments is likely the most prudent choice (Stephens et al. 2010). Management practices that may reduce or remove other non-climate stressors to ecosystems, and that restore ecological processes and heterogeneity, should be the goal (Safford et al. 2012).

Stephens et al. (2010**)** provide this thoughtful introduction to their document *Operational approaches to managing forests of the future in Mediterranean regions within a context of changing climates*:

*Anthropogenic inputs of greenhouse gasses and natural climate variation will continue to change the Earth's climate in the coming decades. While 'climate change' typically connotes 21st-century global warming, the larger context of climate as an ecosystem architect should be assimilated into resource-science thinking. In the past two decades, new tools, new theory, and a critical mass of empirical research have revolutionized understanding of Earth's climate system. Historic climate is now understood as being far more variable and complex than previously imagined. Several key insights have emerged. First, climate naturally changes over time and the changes cycle, or oscillate, rather than wander stochastically or follow pervasive linear trends. It is important when considering 21st-century climate change to recognize that change itself is natural and has precedent. However, the current effect of anthropogenic forcing on the cumulative climate signal is unknown since we have no analog in the past for the present situation.*

In light of past climate change and future projections of climate, Millar and Woolfenden (1999) make some interesting observations:

- Past climate is a potentially confounding factor in using historic reference conditions
- The Medieval Warm Period (900-1350) was a warmer and drier climate phase compared to before or after
- The Little Ice Age (1400-1900) was colder by 2 degrees C than present with glacial advance
- The Current Period (~1900-present) is marked by global temperature increase, with the beginning of the 20th century being the warmest and wettest period in the last 1000 years
- Recruitment of trees is especially sensitive to climate; current old-growth forests regenerated under the climate of the Little Ice Age and may not reflect how old-growth would develop under

present and future climates, and use of reference conditions from this era makes little sense for the present; the Medieval warm period may provide a more representative reference condition for present and future climates projections

Restoration of landscapes towards a historic range of variability found before Euro-American settlement (i.e. Little Ice Age) would still result in forests that are more resistant and resilient to disturbance and expected climate change than most current forests in the western U.S., however consideration of expected future environments is likely a more prudent choice (Stephens et al. 2010).

## Effects on Species Distributions/Growth

Direct effects of projected climate change on forests would be noticed in net primary productivity, tree growth and vigor, and regeneration. Species ranges would be altered due to these factors. East-side PNW forests in the ponderosa pine, Douglas-fir, and grand fir series are generally water-limited systems. Due to expected increased temperatures, reduced snowpack and earlier snowmelt, and longer and more intense dry periods, summer plant moisture deficits would increase (Spies et al. 2010). The area with severe water limitations is expected to increase by 32 percent in the east Cascades and Rocky Mountains of eastern Washington by 2040 due to warmer and drier summers, warmer winters, and less precipitation as snow (Littel et al. 2010).

Current species ranges are expected to shift upward in elevation and northward. Areas of marginal forest cover at low elevations on hot, dry sites may become non-forest, while the area of forest cover at higher elevations may increase. Ponderosa pine and Douglas-fir would expand upward in elevation. The ability of trees to regenerate in these new environments would likely be the major determining factor in these shifts. Two factors could come into play to partially counteract these projected shifts. Genetic plasticity could be expressed in successful regeneration of genotypes that are more drought tolerant but less competitive in the current environment. Also, more mesic micro-sites at lower elevations might maintain species that in general would move upwards in elevation.

Growth is also expected to increase in high elevation temperature-limited forests, while decreasing in lower elevation water-limited systems (Spies et al. 2010). Continuing increases in atmospheric $CO_2$ are expected to increase photosynthesis and tree growth when other factors are not limiting, but at some point growth in relation to $CO_2$ levels would "level off".

## Indirect Effects

Indirect effects of projected climate change on forests would include altered disturbance regimes, especially with regard to fire and insects. It is generally thought that these effects on disturbance regimes would act more rapidly to change forests than changes resulting from altered moisture regimes, phenology and growth, regeneration, and competitive interactions (Spies et al. 2010, Littel et al. 2010, Peterson 2009). An example of a rapid shift in species during an extended drought is the recent dramatic loss of pinyon pine to Ips bark beetles in pinyon-juniper woodlands of the SW U.S., and the resulting dominance of juniper after the outbreak (Peterson 2009). Another example is the current unprecedented mountain pine beetle outbreak in British Columbia which is thought to be due to a warming climate and several recent droughts (Woods et al. 2010). Mortality from fire and insects is also potentially a positive feedback mechanism to atmospheric $CO_2$ levels and potential climate change (Spies et al. 2010).

### Fire

Summer precipitation and temperature play large roles in determining the effects of a given fire season. Reduced snowpacks and warmer summers are expected to lead to longer fire seasons with increased severity and increases in area burned. Increased potential for type conversion and species conversion is expected as well. A two to three fold increase in area burned is projected in the eastern Cascades of Washington by 2080 (Littel et al. 2010). Since climate change would affect both the production and drying of fuels, different vegetation types would respond differently. For example, on drier sites where productivity might be reduced, fire intervals may actually increase due to the increased time necessary for a critical fuel component to carry fire to develop.

### Insects and Disease

Completion of insect life cycles is fundamentally dependent on temperature, and in general increased insect activity and outbreaks would be expected under a warmer climate (Logan et al. 2003). For example, time needed for completion of bark beetle life cycles may go from two years to one, or from one generation per year to more than one per year. We are likely already seeing intensified outbreaks of defoliators compared to historic levels, which may be a function of the increased average temperatures seen since the mid-1970s as well as more continuity and area of host types. Current outbreaks of western spruce budworm in British Columbia are distinguished from previous outbreaks by their expansion into higher elevations and more northerly areas (Woods et al. 2010).

There are many areas of uncertainty with regard to forest insects and climate change. Insect fecundity and ranges would likely change, with the possibility that some insects in this area would be replaced by others. Host phenology (eg. budburst timing) could change in relation to insect development to the benefit or detriment of either, and spruce budworm could become more successful at higher elevations and less successful at warmer, lower elevations (Woods et al. 2010). Insect predators would be affected by climate change as well, with unknown effects on species such as the mountain pine beetle and western spruce budworm. However, current insect modeling results generally indicate intensification in all aspects of outbreak behavior with projected climate change (Logan et al. 2003). In terms of host responses, the reduction in production of defensive chemicals (resins, mono-terpenes, etc.) with increasing moisture stress would theoretically lead to greater host susceptibility.

We might expect to see an increase in activity of pathogens with increasing temperatures as well, but this is a major area of uncertainty due to the complexity of host-pathogen interactions (Beukema et al. 2007). Forest pathogens are more likely to be affected by precipitation changes than by temperature with root diseases such as Armillaria species being the most likely to increase in trees with drought stress (Woods, et al. 2010). Also, decline syndromes such as sudden aspen decline and birch decline which are generally triggered by physiological stress and involve many causal agents are likely to increase where moisture stress due to warming occurs (Woods et al. 2010, Sturrock et al. 2011).

# Information Sources

The main purpose of the HRV/NRV is to inform the development of plan components that promote ecological sustainability. In that light consideration of multiple sources of information provides the most context.

## Historical Information

The 1900 Report on the Bitterroot Forest Reserve (Leiberg 1900) looked at 3.6 million acres of the current 3.9 million acre NPCW NF. Leiberg sectioned the reserve into the five main drainages, the North Fork Clearwater, Lochsa/Middle Fork Clearwater, Selway, South Fork Clearwater, and the Salmon River. Leiberg's District I and District II (North Fork and Lochsa/Middle Fork) within the Bitterroot Reserve approximately cover the portion of Bailey's Section M333D (Bitterroot Mountains) on this planning zone. Districts III, IV, and V (Selway, South Fork, and Salmon) are approximately within Sections M332A (Idaho Batholith) and M332D (Blue Mountains). He described general conditions as well as providing quantitative summaries of forest types and volumes, amounts of old-growth (>175 years old), second growth (75-175 years old), and new growth (<75 years old), areas burned, and species abundance.

A map of white pine distribution was produced, which apparently formed part of the most complete historical reconstruction of white pine distribution before its decline, done by Little (1999) (see Appendix 1, Fig. 1).

Losensky (1994) summarized 1930s inventory data and forest type maps, as well as earlier and later surveys, to arrive at estimates of circa 1900 species composition by cover type, age distribution by cover type, and structural-development stage distribution by cover type. He summarized the data by ecosections, of which 332A Idaho Batholith represents primarily the Nez Perce NF and 333D Bitterroot Mts. represents primarily the Clearwater NF. The old forest structural/development stage used the over-mature age class (151+ years old) from the inventory data as a proxy.

Each ecosection contains broad vegetation and topographic conditions. Local landtype classifications were used to divide each section into three settings, which are roughly equivalent to the subsections described in Ecological Units of the Northern Region: Subsections (Nesser, et al., 1997). These settings are breaklands, uplands, and subalpine. Breaklands are mostly steep slopes at lower elevations, with warmer temperature regimes. Uplands are generally above the breaklands in elevation, and have more rolling topography. They tend to be cooler and more mesic than the breaklands. The subalpine setting is above the uplands in elevation, with mixed topography, and generally colder temperatures. Disturbance regimes differ among the three settings, with more frequent, less severe fire most common on the breaklands, infrequent mixed-severity or stand-replacing fires typical on the uplands, and slightly more frequent than on uplands, mixed and stand-replacing fires on subalpine settings. Because such a small area of the Nez Perce N.F. is in the Blue Mountains Section, historic information for that area was combined with Idaho Batholith information to characterize the Nez Perce NF.

The Idaho Batholith Section description does not mention western redcedar presence, but it is common and widespread in the Selway and Middle Fork Clearwater basins on the Nez Perce National Forest. Therefore, Nez Perce VRUs 8 and 17 (Breaklands and uplands with cedar types) were assigned to the Bitterroot Mts. Breaklands and Uplands, respectively.

The 1937 inventory data has also been summarized to ecosections. This is the earliest complete inventory data available for the Clearwater and Nez Perce National Forests. This inventory covered the entire state of Idaho. Because its extent is so expansive, it includes a broad picture of disturbance processes, and could be thought to display the range of vegetation conditions expected on this landscape over time.

To attribute the forest cover types from the inventory to the three settings, i.e. breaklands, uplands, and subalpine, a map of potential vegetation types was used. This allowed for assigning grand fir and cedar types, for example, to the three settings in proportion to where they could support that cover type. Leiberg's maps of different species locations were also useful in knowing where individual species occurred historically. Size classes were similarly apportioned.

## Leiberg Report

Key points from the 1900 Bitterroot Forest Reserve report are summarized below:

- The N Fork Clearwater drainage was 30% WP by volume, followed by ES-WL at 30%, GF at 10%; the white pine type covered 75% of the area; MH dominated the upper elevations; PP was minor; approximately 30 % of the drainage was old-growth (>175 years old); WP formed the majority of second-growth (75-175 years old); WP occurred up to 5800 ft. elevation; 30% of drainage experienced recent stand-replacing fire (probably 1889)

- The Lochsa/Middle Fork drainage was dominated by ES and DF at 24% and 22% by volume, respectively, followed by PP and WL at 17% and 10%; WP and GF were minor species; noted mining fires which created large expanses of grass/sedge and beargrass-50% of timber experienced recent stand-replacing fires

- The Selway drainage was dominated by the PP-DF type and C; GF and ES were minor species; in the PP-DF type PP was heavier on west and south slopes and PP dominated overall by volume; cedar groves were large old-growth; fires had burned out much DF and C, led to LP regeneration in the subalpine along with creating large, grassy openings

- The South Fork was dominated by GF mixes, covering 65% of the drainage- GF constituted about 50% of the volume with PP and WL together comprising about 40%; noted that WL was more common before fires, as determined from the common presence  large WL stubs; LP likely covered about 20% of the drainage in 90-120 year old stands

- The Salmon River drainage was covered by about 75% PP and 25% DF by volume; noted the low fire severity here and grassy slopes being common due to soils and harsher environment

- Noted that fires had denuded 1.4 million acres, or about 40 percent, of the reserve since the advent of the white man, most due to miners, and that much old-growth in the Selway and South Fork had been destroyed by these fires; noted that big stand-replacing fires had to have occurred in the time period 1750-1800, resulting in the large expanses of 90-130 year-old second-growth

- Estimated that approx. 12% of the reserve was old-growth (>175 years old)

- The historic range of WP is the current North Fork and Palouse Ranger Districts (see Appendix 1, Fig. 1); WP was present, but was a minor species south of these Districts

The fire history of the reserve after the Leiberg Report includes the fires of 1910 in the North Fork and Selway-Bitterroot Wilderness, 1919 in the South Fork, Selway, and North Fork, and 1934 in the Selway, Lochsa/Middle Fork.  In total, these fires burned approximately 1.8 million acres.  These fires may explain the paucity of grand fir and cedar types in the 1937 Nez Perce inventory. Along with the settlement period fires after 1860, they are also most responsible for the expanse of mid-seral/mature forests found on the NPCW today.

## Losensky Report

Key points from the 1994 Losensky Report (circa 1900 reference period) are summarized below by ecosection:

### Idaho Batholith

- PP, DF, and LP cover types comprised two-thirds of ecosection; C, WP, and GF types were minor, but some GF was “washed out” at landscape-level mapping

- The over-mature age class (>150 years) represented 20% of area, mostly in PP and DF types; these were split about evenly between single- and multi-layer structure

- Seeds/saps represented approximately 11% of area, mostly in the LP and WL-DF cover types; 23% of area was in stand initiation stage (seeds/saps plus transitional forest)

- Age distribution more reflective of mixed-severity and stand-replacing fire than other areas in the Columbia River Basin (CRB)

Tables 1-3 (below) present Losensky’s data for cover type, age classes, and structural classes in the Idaho Batholith ecosection.

**Table 1- Cover type circa 1900 in M332A Idaho Batholith (Losensky 1994)**

| Cover Type | % Cover |
|---|---|
| PP Savanna | 0.1 |
| PP | 20.7 |
| DF Savanna | 0.2 |
| DF | 27.2 |
| WL-DF | 0.8 |
| LP | 20.6 |
| ES-SAF | 6.6 |
| Subalpine | 14.6 |
| Sage-Grass | 0.5 |
| Bunchgrass | 8.5 |
| Water | 0.2 |
| Total | 100.0 |

**Table 2- Age Structure circa 1900 for major forest cover types in M332A Idaho Batholith (Losensky 1994)**

| | Percentages of Ecosection by size/age classes | | | | | |
|---|---|---|---|---|---|---|
| **Species** | **Non-stocked** | **0–6 inches 1–40 years** | **6–12/14 inches 41–100 years** | **Mature 101–150 years** | **Overmature >151 years** | **Total %** |
| PP | 6.1 | 2.7 | 9.6 | 23.4 | 58.2 | 100 |
| DF | 15.7 | 9.8 | 27.9 | 28.4 | 18.2 | 100 |
| L-DF | 15.7 | 19.7 | 15.8 | 28 | 20.8 | 100 |
| LP | 17.7 | 34.9 | 35.1 | 9.2 | 3.1 | 100 |
| S-F | 28.6 | 3.6 | 18 | 27.2 | 22.6 | 100 |
| Ave. | 16.8 | 14.1 | 21.3 | 23.2 | 24.6 | 100 |

**Table 3- Percent cover type by structural stage circa 1900 in M332A Idaho Batholith (Losensky 1994)**

| Cover Type | SI | SEOC | SECC | UR | YFMS | OFMS | OFSS | Total % |
|---|---|---|---|---|---|---|---|---|
| PP | 7.4 | 34.4 | 0.0 | 0.0 | 0.0 | 29.1 | 29.1 | 100 |
| DF | 20.6 | 30.6 | 33.6 | 0.0 | 0.0 | 9.1 | 9.1 | 100 |
| WL-DF | 25.6 | 0.0 | 39.6 | 14.0 | 0.0 | 15.6 | 5.2 | 100 |
| LP | 35.2 | 0.0 | 52.6 | 3.4 | 2.3 | 1.5 | 0.0 | 100 |
| WP | 30.4 | 0.0 | 19.8 | 13.6 | 13.6 | 22.6 | 0.0 | 100 |
| ES-SAF | 40.0 | 5.0 | 5.0 | 10.0 | 15.0 | 15.0 | 10.0 | 100 |
| Subalp | 7.4 | 34.4 | 0.0 | 0.0 | 0.0 | 29.1 | 29.1 | 100 |

## Bitterroot Mts.

- WP dominated the species composition at 34%, followed by PP at 21% and WL-DF at 20%; the WL-DF type was intermixed with the WP type on slightly warmer sites, and the WP type was a mix of species
- The over-mature age class (>150 years) represented 27% of area, mostly in WP, PP, and WL-DF; the PP was primarily single-layered, while the WP and WL-DF types were multi-layered
- Seeds/saps represented approximately 19% of area, mostly in the WP, WL-DF, LP, and PP cover types; 32% of area was in stand initiation stage (seeds/saps plus transitional forest)
- Age distribution reflected fires of 1889, which created an abundance of young stands (twice as many as average for the CRB)

Tables 4-6 (below) present Losensky's data for cover type, age classes, and structural classes in the Bitterroot Mts. ecosection.

**Table 4- Cover type circa 1900 in M333D Bitterroot Mts. (Losensky 1994)**

| Cover Type | % Cover |
|---|---|
| PP | 20.8 |
| DF | 2.5 |
| WL-DF | 19.8 |
| WP | 33.8 |
| LP | 9.2 |
| ES-SAF | 2.2 |
| Subalp | 8.2 |
| PSSP-FEID | 1.7 |
| FEID-SYAL | 1.3 |
| Water | 0.5 |
| Total | 100.0 |

**Table 5- Age Structure (% of ecosection by cover type) circa 1900 for major forest cover types in M333D Bitterroot Mts. (Losensky 1994)**

| Cover Type | Non-stocked | Seed/saps | Poles | Mature | Over-mature | Total % |
|---|---|---|---|---|---|---|
| PP | 8.9 | 11.1 | 12.5 | 9.3 | 58.2 | 100 |
| DF | 31.0 | 21.7 | 24.0 | 16.9 | 6.4 | 100 |
| WL-DF | 27.7 | 21.1 | 15.3 | 12.8 | 23.1 | 100 |
| LP | 33.0 | 38.8 | 21.3 | 5.9 | 1.0 | 100 |
| WP | 18.8 | 23.2 | 19.1 | 12.1 | 26.8 | 100 |
| ES-SAF | 23.8 | 4.4 | 13.4 | 24.7 | 33.7 | 100 |

**Table 6- Percent cover type by structural stage circa 1900 in M333D Bitterroot Mts. (Losensky 1994)**

| Cover Type | SI | SEOC | SECC | UR | YFMS | OFMS | OFSS | Total % |
|---|---|---|---|---|---|---|---|---|
| PP | 14.5 | 27.4 | 0.0 | 0.0 | 0.0 | 14.6 | 43.6 | 100 |
| DF | 41.8 | 25.9 | 25.9 | 0.0 | 0.0 | 3.2 | 3.2 | 100 |
| WL-DF | 38.2 | 0.0 | 32.2 | 6.4 | 0.0 | 17.4 | 5.8 | 100 |
| LP | 52.4 | 0.0 | 40.7 | 4.9 | 1.5 | 0.5 | 0.0 | 100 |
| WP | 30.4 | 0.0 | 36.7 | 6.1 | 0.0 | 26.8 | 0.0 | 100 |
| ES-SAF | 26.0 | 0.0 | 15.6 | 12.3 | 12.4 | 33.7 | 0.0 | 100 |
| Subalp | 60.0 | 0.0 | 5.0 | 5.0 | 5.0 | 5.0 | 20.0 | 100 |

## ICBEMP Historic Change Information

The Pend Oreille River Basin in NE Washington/NW Idaho was chosen to analyze vegetation changes in the Columbia Basin, northern Rockies ecoregion. Change was detected by aerial photo interpretation of 1930s and 1980s photos. Observed changes parallel the conditions noted above when comparing existing species composition and size class distribution to historic information. Major trends can be summarized as follows:

- There was a clear shift in overstory composition away from early-seral PP-WL-WP-WBP and a corresponding increase in DF-GF-WH-SAF-ES
- There was a clear increase in tolerant species in the understory
- There was an increase in the area of mid-seral structural types, i.e. a mid-seral bulge in age class distribution

## Simulation Modeling

### Simulation of NRV-State and Transition Modeling- SIMPPLLE Model NRV Runs

- Modeled for 70 decades without timber harvest
- Included climate variation
- Included fire regimes, insects and disease
- Looked at results from all 70 decades (Full NRV) and a subset from four dry periods (Dry NRV)

### Warm/Dry Climate Scenario with Simulation Modeling

A subset of the SIMPPLLE 70 decade simulation with warmer/drier climatic conditions was chosen to represent the potential climate change predictions for the northern Rockies. Differences from the Full NRV simulation are similar for both ecosections and are summarized as follows:

- There is a substantial increase in the grass/shrub type, with slight increases in PP, WL-DF, WBP, LP, and WP (Bitterroot Mts. Only)
- There are substantial decreases in GF/C and SAF-ES

- There is a substantial increase in the seedling/sapling size class, with decreases in all larger size classes

- Disturbance processes (primarily fire) increase, thereby keeping the landscape in a more open condition with large percentages of grass/shrub and young trees, with higher percentages of early-seral, fire tolerant/disease resistant species, and less 20 in.+ size class

## Comparison of Sources- Composition

Tables 7 and 9 (below) summarize information on species composition from the 1937 inventory for the Idaho Batholith (M332A) and Bitterroot Mts. (M333D) ecosections and the biophysical settings within them, with comparison to Losensky, Leiberg, and the NRV full 70 decade simulations. Table 8 and Table 10 present the existing conditions for comparison.

**Table 7- Comparison of historic species composition- Idaho Batholith**

| **IB 332A NP 1937 Inventory Composition %- from Assessment** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| % IB | 0.27 | 0.19 | 0.54 | | **Other Sources- Total for Idaho Batholith** | | | | |
| **Dom Type-Mixed** | **Brk** | **Upl** | **SA** | **Total (wt)** | **Losensky** | **Leiberg** | **NRV Full Brk** | **NRV Full Upl** | **NRV Full SA** |
| PP- WDI | 40 | 27 | 0 | 16 | 21 | 28 | 42-44 | 12-13 | 4-4 |
| DF (dry)- WDT | 27 | 35 | 0 | 14 | 27 | | 12-13 | 3-3 | 5-6 |
| LP | 17 | 24 | 50 | 25 | 21 | | 7-8 | 20-22 | 18-19 |
| WL-DF- MI, SI | 4 | 2 | 1 | 2 | 1 | | 8-8 | 12-13 | 4-5 |
| GF-C- MT | 4 | 12 | 0 | 3 | 0 | | 8-13 | 23-35 | 4-9 |
| WP | 0 | 0 | 0 | 0 | 0 | | 1-1 | 1-1 | 1-1 |
| SAF-ES- ST | 0 | 0 | 29 | 16 | 7 | | 1-2 | 4-6 | 9-22 |
| GS | 8 | 0 | 0 | 2 | 9 | | 3-11 | 7-20 | 6-21 |
| NON | 0 | 0 | 0 | 0 | 0 | | 8-8 | 0-0 | 7-7 |
| SAF-WBP | 0 | 0 | 20 | 11 | 15 | | N/A | N/A | 20-24 |
| Totals | **100** | **100** | **100** | **89*** | 101 | | | | |
| Note: Losensky estimates are for the entire ecosection 332A; Leiberg estimate for PP is for S Fork, Salmon, and Selway drainages; *Assessment appears to have under-allocated PP; Losensky noted DF less important N of Salmon River, GF-WH washed out in mapping, GF-C and WP very minor | | | | | | | | | |

**Table 8- Existing species composition- Idaho Batholith**

| Existing % from VMAP-SPECTRUM | | | |
|---|---|---|---|
| **Dom Type-Mixed** | **Brk** | **Upl** | **SA** |
| PP- WDI | 22 | 1 | 2 |
| DF (dry)- WDT | 12 | 2 | 1 |
| LP | 2 | 8 | 17 |
| WL-DF- MI, SI | 23 | 16 | 23 |
| GF-C- MT | 17 | 41 | 6 |
| WP | 0 | 0 | 0 |
| SAF-ES- ST | 13 | 27 | 41 |
| GS | 4 | 4 | 3 |
| NON | 8 | 0 | 7 |
| SAF-WBP | 0 | 0 | 0 |
| Totals | **100** | **100** | **100** |
| Note: Transitional forest was allocated to representative dominance types | | | |

**Table 9- Comparison of historic species composition- Bitterroot Mts.**

| BM 333D CW 1937 Inventory Composition %- from Asssessment | | | | | Other Sources- Total for Bitterroot Mts. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| % BM | 0.48 | 0.21 | 0.31 | | | | | | |
| **Dom Type-Mixed** | **Brk** | **Upl** | **SA** | **Total (wt)** | **Losensky** | **Leiberg** | **NRV Full Brk** | **NRV Full Upl** | **NRV Full SA** |
| PP- WDI | 15 | 11 | 0 | 10 | 21 | | 6-6 | 1-1 | 1-1 |
| DF (dry)- WDT | 12 | 5 | 0 | 7 | 3 | | 6-6 | 2-2 | 4-4 |
| LP | 0 | 0 | 31 | 10 | 9 | | 3-3 | 3-4 | 30-33 |
| WL-DF- MI, SI | 25 | 35 | 23 | 26 | 20 | | 25-27 | 23-28 | 7-9 |
| WP, GF-C- MT | 31 | 43 | 5 | 25 | 0 | | 11-21 | 14-27 | 6-10 |
| WP | | | | 0 | 34 | 37 | 31-35 | 30-36 | 7-7 |
| SAF-ES- ST | 17 | 6 | 18 | 15 | 2 | | 0-1 | 2-4 | 13-26 |
| GS | 0 | 0 | 0 | 0 | 2 | | 3-11 | 3-17 | 6-19 |
| NON | 0 | 0 | 0 | 0 | 2 | | 1-1 | 0 | 1-1 |
| SAF-WBP | 0 | 0 | 23 | 7 | 8 | | N/A | N/A | 6-7 |
| Totals | **100** | **100** | **100** | **100** | 101 | | | | |
| Assessment combined WP w/GF-C-WH; Losensky/Leiberg reported it all as WP type- both noted that stands were a mix | | | | | | | | | |

**Table 10- Existing species composition- Bitterroot Mts.**

| Existing % VMAP-SPECTRUM | | | |
|---|---|---|---|
| **Dom Type-Mixed** | **Brk** | **Upl** | **SA** |
| PP- WDI | 2 | 0 | 0 |
| DF (dry)- WDT | 4 | 1 | 1 |
| LP | 1 | 2 | 18 |
| WL-DF- MI, SI | 18 | 16 | 14 |
| GF-C- MT | 62 | 70 | 11 |
| WP | 0 | 0 | 0 |
| SAF-ES- ST | 3 | 5 | 44 |
| GS | 8 | 6 | 12 |
| NON | 1 | 0 | 1 |
| SAF-WBP | 0 | 0 | 0 |
| Totals | **99** | **100** | **101** |
| Note: Transitional forest was allocated to representative dominance types | | | |

## Idaho Batholith

When looking at Table 7(Idaho Batholith, primarily the Nez Perce NF) the following conclusions can be drawn given consideration of the differences in methods and the time frames involved:

- There is general agreement among sources for PP when one considers that Losensky was analyzing for the entire ecosection (including south of the Salmon River) and Leiberg was probably biased towards the breaklands and lower uplands due to the limited access at that time. The higher percentage of PP in the uplands and DF in the breaklands and uplands for the historical information versus the Full NRV modeling is likely due to stand-replacing fires of 1889, 1910, 1919, and 1934 which probably left more of these species alive
- All sources show WP as being a very minor species
- The historical information shows the mesic tolerant group (GF-C-WH) as being minor, compared to the Full NRV which predicts it being more substantial (more so than the Dry NRV run, discussed below). This is likely due to both the stand-replacing fires and to broad-scale mapping where this group got “washed out”

Table 8 presents the existing condition. Comparing the existing condition with the HRV/NRV the following are evident:

- PP and WBP are currently under-represented
- WP is under-represented due to the blister rust, although its historic occurrence in this ecosection was very limited
- The mesic tolerant group and SAF-ES are over-represented
- WL-DF is over-represented by the numbers, but it is expected that many of these stands are actually DF-dominated and more larch would be desired
- LP is at low levels across the landscape, primarily due to losses from the mountain pine beetle

### Bitterroot Mts.

When looking at Table 9 (Bitterroot Mts., primarily the Clearwater NF) the following conclusions can be drawn given consideration of the differences in methods and the time frames involved:

- The historical information shows more PP than predicted by the Full NRV simulation.
- Losensky/Leiberg and the Full NRV are quite similar on the amount of WP
- There is general agreement among sources for the WL-DF type, except in the subalpine BpS

Table 10 presents the existing condition. Comparing the existing condition with the HRV/NRV the following are evident:

- PP-WP-WBP-WL are under-represented
- Mesic tolerants are much over-represented in the breaklands and uplands BpS
- SAF-ES are over-represented in the subalpine BpS

## Comparison of Sources- Size Class

Tables 11 and 13 (below) summarize information on age/size class from the 1937 inventory, with comparison to Losensky, Leiberg, and the NRV simulations. Tables 12 and 14 present the existing condition.

### Idaho Batholith

When looking at Table 11 (Idaho Batholith, primarily the Nez Perce NF) the following conclusions regarding size classes can be drawn given consideration of the differences in methods and the time frames involved:

- The historical shows more 20 in. plus size class (2-3x) and less 0-14 in. than the Full NRV simulation
- The 15-19 in. size classes are quite similar between the historical and the simulation

Table 12 presents the existing condition. Comparing the existing condition with the HRV/NRV the following are evident:

- The 20 in. plus size class is below the historical level but above the Full NRV simulation (except in the subalpine BpS)
- The 5-14 in. and 15-19 in. size classes are generally above the historic and simulation levels, representing the “mid-seral bulge”
- The seedling/sapling (0-4 in.) size class is below historic and Full NRV levels; grass shrub is below historic and Full NRV in the uplands BpS

### Bitterroot Mts.

When looking at Table 7 (Bitterroot Mts., primarily the Clearwater NF) the following conclusions regarding size classes can be drawn given consideration of the differences in methods and the time frames involved:

- The historical data shows substantially more 20 in. plus size class and less 0-14 in. than the Full NRV simulation (similar to Idaho Batholith)
- The Full NRV simulation predicts substantially more 5-14 in. and 15-19 in. than the historic, indicating a mid-seral bulge, but not as large as the existing condition

Table 8 presents the existing condition. Comparing the existing condition with the HRV/NRV the following are evident:

- The 20 in. plus size class is below the historical level and on the low end of the Full NRV simulation range

- The 5-14 in. and 15-19 in. size classes are generally above the historic and simulation levels, representing the "mid-seral bulge"

- The grass/shrub and seedling/sapling (0-4 in.) size class is below historic and Full NRV levels

**Table 11- Comparison of historic size classes- Idaho Batholith**

| IB 332A NP 1937 Inventory Size Class %- Assessment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| % IB | 0.27 | 0.19 | 0.54 | | | | | | |
| **Size Class** | **Brk** | **Upl** | **SA** | **Total (wt)** | **Losensky** | **Leiberg** | **NRV Full Brk** | **NRV Full Upl** | **NRV Full SA** |
| Non-forest | 14 | 16 | 22 | 19 | 20 | | 8-8 | 0-0 | 7-7 |
| Grass/shrub | | | | | | | 3-11 | 7-20 | 6-21 |
| 0-4.9 (seeds/saps) | 11 | 13 | 14 | 13 | 11 | | 15-26 | 12-26 | 19-33 |
| 5-14.9 (poles) | 20 | 23 | 25 | 23 | 18 | | 23-33 | 32-49 | 17-32 |
| 15.19.9 (mature) | 24 | 22 | 23 | 23 | 17 | | 23-35 | 17-27 | 16-33 |
| 20+ (over-mature) | 32 | 26 | 16 | 22 | 20 | | 5-10 | 3-6 | 2-7 |
| Totals | **101** | **100** | **100** | **100** | 88 | | | | |
| Notes: Losensky reported only for the major CTs; Leiberg did not report size class data, just old-growth, second-growth, and young-growth for total reserve | | | | | | | | | |

**Table 12- Existing size class distribution- Idaho Batholith**

| Existing %- VMAP-SPECTRUM | | | |
|---|---|---|---|
| **Size Class** | **Brk** | **Upl** | **SA** |
| Non-forest | 8 | 0 | 7 |
| Grass/shrub | 4 | 4 | 3 |
| 0-4.9/transitional forest | 16 | 6 | 18 |
| 5-14.9 | 15 | 28 | 50 |
| 15-19.9 | 33 | 51 | 18 |
| 20+ | 23 | 11 | 5 |
| Totals | **100** | **100** | **100** |
| Note: transitional forest consists of recent fire and timber harvest, and persistent shrubfields | | | |

**Table 13- Comparison of historic size class distribution- Bitterroot Mts.**

| BM 333D CW 1937 Inventory Size Class % | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| % IB | 0.27 | 0.19 | 0.54 | | | | | | |
| **Size Class** | **Brk** | **Upl** | **SA** | **Total (wt)** | **Losensky** | **Leiberg** | **NRV Full Brk** | **NRV Full Upl** | **NRV Full SA** |
| Non-forest | 22 | 23 | 27 | 25 | 13 | | 1-1 | 0-0 | 1-1 |
| Grass/shrub | | | | | | | 2-10 | 2-17 | 6-19 |
| 0-4.9 (seeds/saps) | 16 | 18 | 20 | 19 | 19 | | 12-26 | 10-26 | 19-37 |
| 5-14.9 (poles) | 17 | 16 | 17 | 17 | 15 | | 24-35 | 23-35 | 22-39 |
| 15.19.9 (mature) | 16 | 15 | 16 | 16 | 10 | | 34-36 | 17-30 | 14-30 |
| 20+ (over-mature) | 29 | 29 | 21 | 25 | 27 | | 9-20 | 9-28 | 4-10 |
| Totals | **100** | **101** | **101** | **101** | 84 | | | | |
| Notes: Losensky reported only for the major CTs; Leiberg did not report size class data, just old-growth, second-growth, and young-growth for total reserve and amount of old-growth for N Fork Clearwater which was 30% | | | | | | | | | |

**Table 14- Existing size class distribution- Bitterroot Mts.**

| Existing %- VMAP-SPECTRUM | | | |
|---|---|---|---|
| **Size Class** | **Brk** | **Upl** | **SA** |
| Non-forest | 1 | 0 | 1 |
| Grass/shrub | 8 | 6 | 12 |
| 0-4.9/transitional forest | 5 | 5 | 6 |
| 5-14.9 | 27 | 42 | 52 |
| 15.19.9 | 44 | 39 | 25 |
| 20+ | 14 | 8 | 4 |
| Totals | **100** | **100** | **100** |
| Note: transitional forest consists of recent fire and timber harvest, and persistent shrubfields | | | |

# Desired Conditions from Historical Information/Modelling/Climate Change Considerations

The following tables compare the scoped proposed action with both the Full NRV and Dry NRV simulations, and give a proposal for modified proposed action ranges for dominance types and size classes. The rationale for the modified proposed action DCs is based on the following specific considerations:

1. The desired condition is increased resilience to fire, drought, insects, and disease; PP, WL, WP, and WBP are species that are more resistant to these disturbances in their respective environments

2. Climate change predictions for this region by 2040 include increased average annual temperature, increased average minimum and maximum temperatures in summer and winter, decreased snowpack, and decreased summer precipitation (EcoAdapt 2014). In general, there will be increased moisture stress on trees and associated vegetation in all biophysical settings (BpS)

3. PP is the most drought-tolerant species, while GF-C-WH are the least drought-tolerant. PP, DF, WL, and WP are all expected to move up in elevation, albeit with interactions with slope/aspect and soils

Rationale and methodology for desired condition ranges for species composition in the modified proposed action includes:

1. Increase PP in all BpS, but especially in the breaklands and uplands, due to its drought and fire tolerance, and resistance to root diseases. We expect some loss of PP in grass-shrub ecotone but this can be somewhat ameliorated by thinning and burning in existing stands and planting after wildfire

2. Increase WL in the upland and subalpine BpS in light of its resistance to fire and insects and disease; the most appropriate sites will be on N and E aspects at mid-elevations

3. Increase WP in all BpS in the Bitterroot Mts. due to its historic role and status as a long-lived seral dominant throughout the grand fir-cedar-hemlock habitat types and importance in the subalpine as well. WP has resistance to root disease and fire, and with rust-improved F2 stock is expected to regain status as an important tree species

4. Increase WBP in the subalpine BpS due to its greater drought tolerance and importance as a keystone species at high elevations. Again, rust-improved stock will be necessary.

5. Decrease GF-WH-SAF due to their greater susceptibility to insects, disease, and fire. C will be best maintained on the moister sites

6. Historical information was used as a “reality check” on ranges generated from simulation modeling, especially with regards to species composition related to resilience, i.e. WP, PP, WL, WBP and amounts of species currently dominating the landscape, i.e. the mixed mesic group of GF/C/WH

Rationale and methodology for desired condition ranges for size classes in the modified proposed action includes:

1. Decrease the predicted expansion of grass/shrub communities into the PP zone through active management, including thinning/burning existing PP stands, landscape fuels treatments designed to reduce fire spreads and intensity, and reforestation with ponderosa pine after fire

2. The seedling/sapling size class is currently low compared to historic information, and there is a need to move 15-19 in. mixed mesic GF/C towards more PP-WL-WP through regeneration harvest to increase resilience and re-establish WP; however, due to active management, including fire suppression we would not expect as much stand-replacing fire as predicted by the simulation modeling

3. Maintain adequate mid-seral to move into the very large size class, but reduce the "mid-seral bulge" that currently exists and is predicted to remain through the effects of fire in the modeling

4. Maintain the very large size class (20 in.+) (proxy for old-growth) at a minimum of 10% (except in slower-growth subalpine BpS) and set the upper bound at approximately the level of the historic information. This provides a range for management options, maintains current direction on old-growth, and provides a realistic upper limit given the past and expected future role of fire in this landscape.

| Idaho Batholith Breaklands | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 21 | 41 | 42 | 44 | 40 | 46 | 42-50 |
| Douglas-fir | 19 | 37 | 12 | 13 | 11 | 13 | 11-13 |
| Lodgepole pine | 3 | 7 | 7 | 8 | 7 | 8 | 7-8 |
| Western larch/Douglas-fir | 3 | 7 | 8 | 8 | 7 | 8 | 7-8 |
| Grand fir/western redcedar | 11 | 21 | 8 | 13 | 3 | 10 | 3-10 |
| White pine | 0 | 0 | 1 | 1 | 1 | 2 | 1-2 |
| Subalpine fir/spruce mix | 2 | 4 | 1 | 2 | 1 | 1 | 1-1 |
| Seral grass/shrub | 8 | 16 | 3 | 11 | 8 | 19 | 6-15 |
| Nonforest | | | 8 | 8 | 8 | 8 | 8 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 16 | 16 | 8 | 8 | 8 | 8 | 8 |
| Seral grass/shrub | 6 | 15 | 3 | 11 | 8 | 19 | 6-15 |
| 0-4.9 inches | 3 | 7 | 15 | 26 | 25 | 41 | 7-20 |
| 5-14.9 inches | 25 | 49 | 23 | 33 | 11 | 27 | 20-40 |
| 15-19.9 inches | 10 | 20 | 23 | 35 | 16 | 31 | 10-25 |
| >= 20 inches | 11 | 23 | 5 | 10 | 4 | 9 | 10-32 |

| Idaho Batholith Uplands | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 11 | 23 | 12 | 13 | 11 | 14 | 17-40 |
| Douglas-fir | 11 | 23 | 3 | 3 | 3 | 4 | 3-10 |
| Lodgepole pine | 15 | 29 | 20 | 22 | 18 | 24 | 18-24 |
| Western larch/Douglas-fir | 3 | 7 | 12 | 13 | 10 | 14 | 10-20 |
| Grand fir/western redcedar | 21 | 41 | 23 | 35 | 4 | 31 | 4-25 |
| White pine | 0 | 0 | 1 | 1 | 0 | 1 | 1-2 |
| Subalpine fir/spruce mix | 2 | 4 | 4 | 6 | 2 | 6 | 2-6 |
| Seral grass/shrub | 3 | 7 | 7 | 20 | 13 | 43 | 7-10 |
| Nonforest | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| Seral grass/shrub | 3 | 7 | 7 | 20 | 13 | 43 | 7-10 |
| 0-4.9 inches | 6 | 13 | 12 | 26 | 22 | 43 | 15-25 |
| 5-14.9 inches | 21 | 41 | 32 | 49 | 6 | 36 | 20-45 |
| 15-19.9 inches | 25 | 47 | 17 | 27 | 8 | 25 | 10-35 |
| >= 20 inches | 11 | 25 | 3 | 6 | 2 | 6 | 10-25 |

| Idaho Batholith Subalpine | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 0 | 0 | 4 | 4 | 4 | 5 | 4-10 |
| Douglas-fir | 4 | 7 | 5 | 6 | 5 | 6 | 5-7 |
| Lodgepole pine | 12 | 23 | 18 | 19 | 17 | 20 | 17-20 |
| Western larch/Douglas-fir | 3 | 6 | 4 | 5 | 4 | 5 | 5-15 |
| Grand fir/western redcedar | 0 | 0 | 4 | 9 | 2 | 7 | 2-7 |
| White pine | 0 | 0 | 1 | 1 | 1 | 1 | 1-2 |
| Subalpine fir/spruce mix | 16 | 31 | 9 | 22 | 5 | 14 | 5-14 |
| Subalpine fir/whitebark pine | 13 | 27 | 20 | 24 | 20 | 26 | 20-26 |
| Seral grass/shrub | 3 | 6 | 6 | 21 | 16 | 29 | 6-20 |
| Nonforest | 20 | 20 | 7 | 7 | 7 | 7 | 7 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 20 | 20 | 7 | 7 | 7 | 7 | 7 |
| Seral grass/shrub | 3 | 6 | 6 | 21 | 16 | 29 | 6-20 |
| 0-4.9 inches | 10 | 20 | 19 | 33 | 35 | 42 | 15-30 |
| 5-14.9 inches | 23 | 47 | 17 | 32 | 7 | 18 | 20-35 |
| 15-19.9 inches | 10 | 17 | 16 | 33 | 11 | 25 | 10-30 |
| >= 20 inches | 4 | 6 | 2 | 7 | 1 | 5 | 5-15 |

| Bitterroot Mountain Breaklands | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 9 | 19 | 6 | 6 | 5 | 6 | 10-20 |
| Douglas-fir | 14 | 22 | 6 | 6 | 6 | 7 | 5-7 |
| Lodgepole pine | 0 | 0 | 3 | 3 | 2 | 3 | 2-3 |
| Western larch/Douglas-fir | 13 | 20 | 25 | 27 | 23 | 29 | 20-30 |
| Grand fir/western redcedar | 9 | 17 | 11 | 21 | 7 | 15 | 5-15 |
| White pine | 10 | 25 | 31 | 35 | 31 | 37 | 25-35 |
| Subalpine fir/spruce mix | 0 | 0 | 0 | 1 | 0 | 1 | 0-1 |
| Seral grass/shrub | 8 | 15 | 3 | 11 | 8 | 20 | 5-15 |
| Nonforest | 10 | 10 | 1 | 1 | 1 | 1 | 1 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 10 | 10 | 1 | 1 | 1 | 1 | 1 |
| Seral grass/shrub | 8 | 17 | 2 | 10 | 7 | 19 | 5-15 |
| 0-4.9 inches | 6 | 13 | 12 | 26 | 26 | 42 | 10-20 |
| 5-14.9 inches | 17 | 36 | 24 | 35 | 12 | 30 | 20-35 |
| 15-19.9 inches | 16 | 33 | 34 | 36 | 16 | 31 | 15-35 |
| >= 20 inches | 17 | 33 | 9 | 20 | 5 | 14 | 10-35 |

| Bitterroot Mountains Uplands | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 5 | 10 | 1 | 1 | 1 | 1 | 10-15 |
| Douglas-fir | 5 | 15 | 2 | 2 | 2 | 2 | 1-4 |
| Lodgepole pine | 3 | 7 | 3 | 4 | 3 | 5 | 3-6 |
| Western larch/Douglas-fir | 7 | 15 | 23 | 28 | 21 | 31 | 20-30 |
| Grand fir/western redcedar | 15 | 25 | 14 | 27 | 7 | 20 | 5-25 |
| White pine | 20 | 40 | 30 | 36 | 30 | 39 | 25-35 |
| Subalpine fir/spruce mix | 0 | 2 | 2 | 4 | 1 | 4 | 1-4 |
| Seral grass/shrub | 3 | 7 | 3 | 17 | 12 | 29 | 5-10 |
| Nonforest | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| Seral grass/shrub | 3 | 7 | 2 | 17 | 12 | 29 | 5-10 |
| 0-4.9 inches | 6 | 13 | 10 | 26 | 24 | 41 | 15-30 |
| 5-14.9 inches | 21 | 41 | 23 | 35 | 8 | 29 | 20-40 |
| 15-19.9 inches | 24 | 48 | 17 | 30 | 11 | 25 | 15-25 |
| >= 20 inches | 12 | 24 | 9 | 28 | 4 | 17 | 10-30 |

| Bitterroot Mountain Subalpine | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Proposed Action | | Full NRV Range | | Dry NRV Range | | Modified PA |
| **Dominance Type** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Ponderosa pine/mix | 0 | 0 | 1 | 1 | 1 | 1 | 1-3 |
| Douglas-fir | 7 | 13 | 4 | 4 | 4 | 5 | 5-10 |
| Lodgepole pine | 18 | 38 | 30 | 33 | 27 | 36 | 25-35 |
| Western larch/Douglas-fir | 4 | 8 | 7 | 9 | 6 | 10 | 5-15 |
| Grand fir/western redcedar | 0 | 0 | 6 | 10 | 2 | 12 | 5-10 |
| White pine | 5 | 9 | 7 | 7 | 6 | 8 | 5-15 |
| Subalpine fir/spruce mix | 8 | 18 | 13 | 26 | 7 | 23 | 5-20 |
| Subalpine fir/whitebark pine | 11 | 20 | 6 | 7 | 5 | 8 | 5-15 |
| Seral grass/shrub | 6 | 12 | 6 | 19 | 14 | 28 | 5-15 |
| Nonforest | 14 | 14 | 1 | 1 | 1 | 1 | 1 |
| | | | | | | | |
| **Size Class** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | |
| Non-forest | 14 | 14 | 1 | 1 | 1 | 1 | 1 |
| Seral grass/shrub | 11 | 23 | 6 | 19 | 14 | 28 | 5-15 |
| 0-4.9 inches | 3 | 5 | 19 | 37 | 34 | 55 | 10-25 |
| 5-14.9 inches | 39 | 79 | 22 | 39 | 5 | 27 | 20-45 |
| 15-19.9 inches | 7 | 14 | 14 | 30 | 9 | 23 | 15-40 |
| >= 20 inches | 4 | 8 | 4 | 10 | 2 | 7 | 5-20 |

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# Appendix 1- Historic Western White Pine Distribution

**Figure 1-Historic western white pine distribution in Idaho and Clearwater NF** *(from: Crist, Michele, Dave Theobald, and Brett Dickson. 2014. A landscape-scale modeling framework and strategy for restoring western white pine in the Northern Rockies, USA. Final Report from Conservation Science Partners, 55 p*